

REMARKS/ARGUMENTS

Applicants will respond to the various items in the office action in the order they are presented.

Examiner's Paragraph 1:

Drawings

The Examiner has objected to the drawings under 37 C.F.R. § 1.83(a) as not showing "...every feature of the invention specified in the claims." In particular the Examiner suggests that the 'groups' of injectors recited in the claims are not identified in the drawings. Applicant respectfully disagrees with the Examiner's interpretation of the claims and presents the following argument. The specification clearly explains that grouping of injectors is flexible and under selective control of the electronic control unit. Thus, in one instance 6 injectors may be selected by the electronic control unit as 1 group of 6. At another time the control unit may select 2 groups of 3 from the 6 injectors. Yet at another time, the control unit may select 3 groups of two. It is for this reason that the drawings do not show interconnections between injectors that would indicate groupings of a specific size. Applicant believes the drawings correctly reflect the invention. In order to more particularly point out this feature, Applicant has amended the claims to recite selectable groups and that the groups of injectors are "selected." With these amendments Applicant believes that the claims more particularly recited the features of the invention and overcome the Examiner's objection to the drawings. Applicant respectfully requests that the Examiner withdraw the objection and new drawing requirement.

Examiner's Paragraph 2:

Specification/Abstract

The Examiner has noted that the Abstract should be between 50 to 150 words in length and avoid legal phraseology. Applicant has requested deletion of the original Abstract and amendment of the Specification by the insertion of a new Abstract. Applicant has included no new matter in the replacement Abstract and submits that it fully meets the Examiner's requirements.

Examiner's Paragraph 4:

Claim Rejections - 35 U.S.C. § 112

The Examiner has rejected claims 6, 9, and 12 "...as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention." With respect to claim 6, the Examiner has noted that the terms "said combustion zone" and "said turbine engine's shaft" lack sufficient antecedent basis. Applicant has amended the claim to recited "combustion chamber" and to provide antecedent basis for reference to the engine shaft.

With respect to claim 9, the Examiner has noted that there is insufficient antecedent basis for "said programmable electronic control unit." Applicant has amended independent claim 7 from which claim 9 depends to provide the correct antecedent basis. Claim 7 has generally been amended to more particularly point out and distinctly claim the subject matter Applicant regards as his invention.

With respect to claim 12 the Examiner has noted that there is insufficient antecedent basis for "said combustion zone" and "the shaft." Applicant has amended the claim to recite a

"combustion chamber" and has amended independent claim 7 from which claim 12 depends to provide correct antecedent basis for the recitation of an engine shaft.

Examiner's Paragraph 6:

Claim Rejections - 35 U.S.C. § 102

The Examiner has rejected claims 1 - 12 "...under U.S.C. 102(b) as being anticipated by Ng (US 5,205,116)." Applicant submits that the teaching of Ng is not anticipatory of Applicant's invention, but in fact teaches away from Applicant's invention.

Ng teaches splitting the injectors into 2 groups with the normal operation providing fuel to both groups equally. Ng states:

"In the event that a stall condition is detected by the engine control system, or other suitable means, a control signal is delivered to a valve actuator 27a so as to move the valve 27 to an operable position whereby one of the two manifolds 36 and 37 is cut off from the fuel line 21. Thus, according to the embodiment illustrated in FIG 3, every other one of the nozzles will be cut off from the supply of fuel." 9Col. 4, line 15-22)

Ng further reinforces this description of the operation of his invention in Claim 7 "...upon detection of a stall condition so as to block the flow of fuel to one of the first and second manifolds."

Nowhere within 5,205,116 does Ng teach that the stoppage of flow is alternated and at no time is there a period when both manifolds are deprived of fuel such as is accomplished by the present invention at less than 50% load. By way of a further difference between Ng's teaching and that of Applicant, Ng is not using fuel shut off from one group to control overall engine operation as Applicant teaches. Ng's system merely teaches an override of normal operation in

the event of a stall condition with his "split manifold" arrangement.

Controller 23 is the adjusting means for engine load, not his fuel cut off system. However, unlike Applicant's system, Ng does not modulate the individual injectors to control fuel to the combustion chamber. Ng's valves, like all others in the prior art, are upstream of the actual injectors and control fuel flow in a line that then goes to one or more injectors. This teaching clearly does not anticipate Applicant's.

For all these reasons, Applicant submits that Ng does not anticipate Applicants invention and Applicant respectfully requests that the Examiner withdraw the rejection.

Examiner's Paragraph 7:

Claim Rejections - 35 U.S.C. § 102

The Examiner has rejected claims 1 - 12 "...under U.S.C. 102(b) as being anticipated by Iwai (US 5,339,635)." Applicant submits that the teaching of Iwai can not and does not anticipate Applicant's invention.

Iwai teaches using a number of injectors, but, once again as with Ng, Iwai never shuts off all fuel flow to the engine. The use of Iwai's multiple injector concept is most easily seen in Figure 4 where he graphically shows a base flow accomplished through adjusting valve 40. In response to greater and greater load, Iwai opens a greater and greater number of stop valves 50. Iwai is merely using the multiple injection points to maintain stable flames at each injector during low loads. This is essentially "digital" control rather than "analog" control of the fuel supply. Rather than operating with all individual injectors being throttled from minimum to maximum flows, Iwai uses a smaller or greater number of injectors that are either all on or all off. In contrast and most importantly, Applicant teaches a very different control system. In

Applicant's invention, each individual injector can be controlled to provide fuel injection from none to a maximum value. This is accomplished by the "on" time of the injector that is determined by the control unit. Also, in Applicant's invention, the duty cycle of each injector or injector group can be controlled so that there may be times when all injectors are dispensing fuel and other times when no fuel is being dispensed.

For all these reasons, Applicant submits that Iwai does not anticipate Applicants invention, and Applicant respectfully requests that the Examiner withdraw the rejection.

Examiner's Paragraph 9:

Claim Rejections - 35 U.S.C. § 103

The Examiner has rejected claims 1 - 12 "...under U.S.C. 103 as being obvious in view of several U.S. patents and directs attention to figures in each cited patent. Applicant submits that none of these patents individually or collectively anticipate Applicant's invention.

Applicant will respond briefly highlighting the major difference between the teaching of each patent and Applicant's invention.

US 3,688,495: Unlike Applicant's invention, in '495 the fuel flow is never being shut off. Further the fuel flow is controlled upstream of the point of use (at the injectors) and directed to the point of use through a conduit where it was then atomized. Applicant controls the fuel flow at the injectors. Further Applicant dispensed with the conduit to achieve control and atomization at the point of use (the injectors in the combustion chamber).

US 5,339,620: This patent teaches splitting the fuel supply into 2 parts: "...fuel is supplied to the first stage fuel nozzle 7 through a first stage fuel regulation valve 5. Second stage fuel is supplied to the second stage fuel nozzle 9 through a second stage fuel regulation valve 4

and pipes 6, 1.” Mention is generally made that the fuel supply is controlled to some extent, but, more importantly, all claims and drawings are based upon a “...means for correcting an intake air flow rate or a ratio of fuel flow rate to the intake air flow rate...”. Of note is the fact that the abscissa on Figures 2, 3, 4, 5 are all “intake air absolute humidity” and that the ordinates of these figures are either “second stage air flow rate” or “second stage fuel/air flow ratio.” Figure 6 reinforces the control of air not fuel in that block 32 is the only mention of fuel, and only of second stage fuel, everything after that is the control of second stage air. Clearly this patent does not anticipate the electronic control using duty cycles of individual or groups of injectors placed into the combustion chamber.

US 6,145,297 This invention operates in a very similar fashion to Iwai. The most obvious point in this patent is provided by Figure 3 and the discussion about Figure 3. At low loads (called zero to point a) fuel is supplied purely through valve 10. As load is increased (called point a) valve 4a is opened to utilize another injection point. As load increases (from point a to point b) the injector connected to valve 4a runs at a steady state condition while more fuel is supplied through valve 10 until point b is reached. Upon reaching point b, valve 4b is now opened to utilize an additional injection point. Although 2 "break points" are explained more would be possible. This is substantially the same control philosophy used by Iwai. Once again there is no operating point where all fuel is shut off or pulsed in any fashion. Applicant incorporates in response to this patent citation, Applicant's remarks directed to Iwai,

US 6,761,032: This invention merely teaches the insertion of a “dynamic correction unit 17” between the “power control unit 13” and the “valve control unit 21”. The

objective of the "dynamic control unit 17" is to act as a feedback loop to correct actual output flow occurring into the combustion chamber based upon the requested flow from the "power control unit 13" based upon the sensor "18" feeding the "dynamic control unit 17" caused by such things as system resistance, fuel temperature, combustion pressure, etc. This operational mode is called out in Claim 3 as "the fuel temperature in the fuel supply system is taken into account."; similarly in Claim 4 with "the combustion chamber pressure". Claim 6 with "the volume, filled with fuel"; and in Claim 7 "exit cross section of all the burners of the burner arrangement from which the exits from the burner arrangement, and/or a **flow resistance** of the burner arrangement". There is no fuel flow control of individual injectors or grouping and modulation of groups of injectors.

US 6,877,307: This invention uses a "main fuel supply throttle valve 20" and a "pilot fuel supply throttle valve 24". All that the system of this patent is doing is throttling the fuel supplies to the pilot burner and the main burner in response to load with the positioning of the valves being overridden if combustion instability (acoustical vibration) is detected.

US 2002/0178733: The relevance of this patent is not clear to Applicant. There may be two control valves (9 and 10 of the figure) but they do not operate in any matter similar to Applicant's invention. The system of this patent is clearly injecting fuel through valve 9:

"In the FIGURE, a signal line 56 extends, as an example, from the control module 50 to a fuel quantity adjusting element 9.....the water quantity is set through the water quantity adjusting element 10. The water quantity adjusting element is controlled by the control module 50 via a signal line 57."

This two valve system bears no resemblance to and does not anticipate Applicant's invention.

US 2002/0194851: This patent disclosure is very similar to 6,877,307 in that in Claim 1 states:

"A method for running up a gas turbine plant (1), in which at least one fuel (6) is burnt in a combustion chamber (5) and the hot combustion gases (9) occurring at the same time are led through a gas turbine (2) and thereafter discharged as exhaust gases (12), in which method the at one fuel (6) is injected into the combustion chamber (5) via a plurality of pilot burners (10) and premix burner (11)"

Clearly, this indicates two different burner functions. Claim 12 further clarifies the differing functions of (10) and (11):

"characterized in that the pulse of the injected fuel stream of the pilot burners (10) is modified."

Once again, the object of this patent disclosure is not to utilize both types of burners to control output but to control acoustic vibrations (here called pulsations). Applicant uses one type of injector (burner) and uses the injectors to control engine output.

US 6,820,429: Applicant does not understand the Examiner's citation to this patent document. Neither the description nor Figure 1 seems in the least similar to Applicant's invention. The system shown in this document shows only **one** fuel control valve 32.

US 5,349,811: This patent document also does not anticipate Applicant's invention. Of particular note is the section in column 7 beginning on line 38:

"The primary innovative element is introduction of the major volume of the fuel supply in the form of a steady flow plus a uniformly pulsed fuel delivery to the combustion, under conditions which drive a controlled degree of combustion flow oscillation."

This operation of the described invention is further reinforced in Claim 2:

"The process according to claim 1 in which said modulations comprise repeated transient increases or decreases in the fuel supply relative to the normal continuous rate of fuel supply."

As in some of the other patents cited by the Examiner, a base flow is superimposed with a pulsed flow. This is not at all similar to Applicant's invention where the flow from each injector is modulated according to the control needs of the engine.

As presented above, Applicant respectfully submits that none of the cited patents individually or together anticipates or renders obvious Applicant's invention. Applicant respectfully requests that the Examiner withdraw the rejection.

Applicant submits that he has addressed and overcome all of the Examiner's objections and rejections, and respectfully requests that the Examiner pass the application to issue.

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Respectfully submitted,



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